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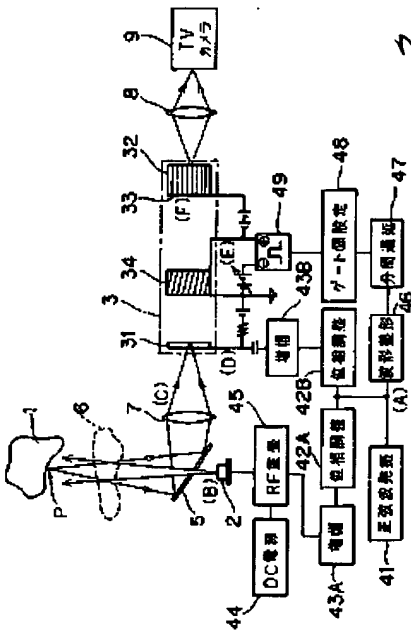
(71)出願人　000236436
浜松ホトニクス株式会社
静岡県浜松市市野町1126番地の１

(72)発明者　中村　治仁
静岡県浜松市市野町1126番地の１　浜松ホトニクス株式会社内

(74)代理人　弁理士　長谷川　芳樹　（外３名）

(54)【発明の名称】　イメージレーザレーダ装置

(57)【要約】
【目的】　イメージレーザレーダ装置を改良する。
【構成】　所定周波数で輝度変調され、出射光を被写体（１）に投射するレーザ光源（２）と、被写体からの反射光を受光して像増強する機能を有し、所定周波数でゲインが変調されるイメージインテンシファイヤー管（３）と、このゲイン変調周期の略１／４以下の周期であってゲインが単調に増加または減少する期間においてのみイメージインテンシファイヤの出力をオンとするゲート手段とを備える。したがって、これらの周期が同期することにより、距離に応じて濃淡が周期的に繰り返して変化する情報が得られるため、ゲート手段により制御により、上記のゲインが単調増加または減少する期間のみイメージインテンシファイヤ管の出力をオンとすることで設定された距離範囲のみの測距結果を濃淡イメージを得ることができる。



No distance calc.

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【特許請求の範囲】

【請求項１】　所定周波数で輝度変調された、出射光を被写体に投射するレーザ光源と、前記被写体からの反射光を受光して像増強する機能を有し．前記所定周波数でゲインが変調されるイメージインテンシファイヤー管と．このイメージインテンシファイヤー管のゲイン変調周期の略１／４以下の周期であってゲインが単調に増加または減少する期間においてのみ前記イメージインテンシファイヤの出力をオンとするゲート手段とを備えることを特徴とするイメージレーザレーダ装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明はイメージレーザレーダ装置に関するものである。

【０００２】

【従来の技術】位相比較法（光変調位相比較法）を用いた測距が知られている。これは、正弦波で輝度変調した連続波（光ビーム）を送出し、被写体からの反射光を受信して検波した後、送出波と検出波の位相を比較することにより測距するものである。この測距において．受信器側でゲートをかけることにより測距のＳ／Ｎを向上させる技術が、例えば特開平２－１３８７８号公報に開示されている。これによれば．被写体までの大気中に存在する散乱体などに影響されることなく．被写体までの距離を正確に測定することができる。

【０００３】

【発明が解決しようとする課題】しかし、上記の従来技術では、被写体からの反射光の受信手段について．格別の工夫がされておらず、このため実用的価値が不十分である。ところで．レーザレンジゲート動作を行なう受信手段として、近接型ＩＩ（イメージインテンシファイヤー）管と呼ばれるものがある。このデバイスによれば、被写体からの微弱な光信号をも、増強したイメージとして再生できる。

【０００４】そこで本発明は、この近接型ＩＩ管の特徴を活用することにより、従来にはない新規のイメージレーザレーダ装置を提供することを目的としている。

【０００５】

【課題を解決するための手段】本発明にかかるイメージレーザレーダ装置は、所定周波数で輝度変調された出射光を被写体に投射するレーザ光源と．被写体からの反射光を受光して像増強する機能を有し．所定周波数でゲインが変調されるイメージインテンシファイヤー管と、このイメージインテンシファイヤー管のゲイン変調周期の略１／４以下の周期であってゲインが単調に増加または減少する期間においてのみイメージインテンシファイヤの出力をオンとするゲート手段とを備えることを特徴とする。

【０００６】

【作用】本発明では、イメージインテンシファイヤ管の

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光電面またはＭＣＰ（マイクロチャンネルプレート）にパルスまたは正弦波電圧を印加し、同時に被写体には上記イメージインテンシファイヤ管の変調周波数と同一または少しずれた周波数で輝度変調されたレーザ光を照射しており、したがって、これらの周期が同期することにより．距離に応じて濃淡が周期的に繰り返して変化する情報が得られる。このため．ゲート手段による制御により．イメージインテンシファイヤ管のゲイン変調周期の略１／４以下の周期であってゲインが単調増加または減少する期間のみイメージインテンシファイヤ管の出力をオンとすることで、このゲート手段によるレーザレンジゲートにより設定された距離範囲のみ．測距結果を画像の濃淡イメージで得ることができる。

【０００７】

【実施例】以下．図１，２を参照して本発明の一実施例を説明する。図１は実施例に係るイメージレーザレーダ装置の構成を示すブロック図であり．図２はこの実施例の動作を示す波形図である。図１に示す通り、本実施例のイメージレーザレーダ装置は、被写体１に正弦波で輝度変調されたレーザ光を投射するレーザ光源２と．被写体１からの反射光を受光するイメージインテンシファイヤ管３と、これらの動作をコントロールする回路系とを備えて構成されている。

【０００８】正弦波発生回路４１は輝度変調、ゲイン変調およびゲート動作タイミングの基準となる正弦波電圧を発生するもので、その出力は位相調整回路４２Ａ，４２Ｂを経て増幅器４３Ａ、４３Ｂに与えられる。位相調整回路４２Ａ、Ｂは正弦波発生回路４１の出力に位相差を与えるもので．増幅器４３Ａ，Ｂは位相差の与えられた正弦波電圧を単に増幅する。ＤＣ電源回路４４からＤＣ電力が供給されるＲＦ重畳回路４５は、増幅器４３Ａからの正弦波電圧を搬送波すなわち所定のＲＦに重畳し．レーザ光源２に与える。レーザダイオード等のレーザ光源２からのレーザ光はミラー５に形成されたスルーホールを通して．被写体１に向けて空間中に投射される。なお、被写体１とレーザ光源２の間の空間中には、散乱等を生じさせる障害物質６が浮遊して存在している。

【０００９】被写体１からの反射光は．ミラー５で反射されレンズ７を介してイメージインテンシファイヤ管３に入射されるよう構成される。イメージインテンシファイヤ管３は受光面板の内面に光電面３１を有し．出力面であるファイバ光学プレート３２の内面には螢光面３３を有し、光電面３１と螢光面３３の間の真空容器中には電子増倍用のＭＣＰ３４が設けられている。そして、螢光面３３の光学像はファイバ光学プレート３２およびリレーレンズ８を介してＴＶカメラ９により撮像される。

【００１０】ここで、イメージインテンシファイヤ管３の光電面３１には増幅器４３Ｂの出力．すなわち正弦波電圧が与えられ．これによってゲイン変調がなされてい

る。また、正弦波発生回路４１からの正弦波電圧は波形整形回路４６で波形整形され、分周および遅延回路４７を経てゲート幅設定回路４８に与えられる。そして、ゲート幅設定回路４８の出力はＭＣＰゲート駆動回路４８に与えられ、この出力はＭＣＰ３４に印加されてゲート動作がされる。

【００１１】上記実施例の動作を図２のタイミングチャートにより説明する。図２において．正弦波電圧波形（Ａ）は正弦波発生回路４１の出力波形、光強度波形（Ｂ）はレーザ光源２の出力レーザ光の強度波形．波形（Ｃ）はイメージインテンシファイヤ管３の光電面３１に入射する被写体１からの反射光の強度波形を示している。ここで、波形（Ａ）と波形（Ｂ）の間の位相差Ｔ，は．位相調整回路４２Ａによって設定されたものであり．波形（Ｂ）と（Ｃ）の間の位相差Ｔ，は、レーザ光の空間中の伝播による時間遅れである。

【００１２】円周の波形（Ｄ）は光電面３１の電圧波形であり、これは波形（Ｃ）つまりイメージインテンシファイヤ管３への入力光の強度変化と同期している。波形（Ｅ）はＭＣＰ３４に与えられるゲート電圧であり、ゲート電圧が正になっている期間のみ．ＭＣＰ３４による光電子増倍がされる。つまり、その前後の期間Ｔ，，Ｔ，の期間はシャッタが閉じられたのと同じになるので、波形（Ｅ）のパルス期間のみ、被写体１の情報がイメージとして撮られることになる。なお．波形（Ｅ）のパルス間隔Ｔ，のタイミングは分周および遅延回路４７によって調整される。

【００１３】図２の波形（Ｆ）はイメージインテンシファイヤ管３の螢光面３３の電圧波形．つまりＴＶカメラ９への光出力波形である。すなわち．波形（Ｅ）のようにＭＣＰ３４の電圧が正のとき以外は．螢光面３３の光出力はゼロとなり、ＭＣＰ３４の電圧が正でゲートが開いているときのみ、螢光面３３はイメージを出力する。このとき、ゲートが開いている期間は．波形（Ｃ）に示す光電面３１への入力光強度が単調に減少する期間および光電面３１への電圧（波形（Ｄ））が単調に減少する（つまり、ゲインが単調に減少する）期間の両方に対応しているので．ＭＣＰ電圧がオンの期間のみの像は一定の距離範囲の像となり、かつ近い位置は明るく．遠い位置は暗く濃淡で表示されることになる。

【００１４】上記実施例では、イメージインテンシファイヤ管３のゲインおよび被写体１からの反射光の強度が単調減少する期間に、イメージインテンシファイヤ管３のゲート期間を設定しているが、ゲインおよびイメージインテンシファイヤ管３への入射光強度が単調増加する期間に、イメージインテンシファイヤ管３のゲート期間

を設定してもよい。このようにすると．一定の距離範囲内にある被写体のうち、近いものが暗く、遠いものが明るく濃淡表示される。

【００１５】また、ゲインの変調はイメージインテンシファイヤ管３のＭＣＰへの印加電圧を正弦波変調することで行ない、イメージインテンシファイヤ管３の光電面３１への電圧をオン，オフさせることでゲート動作を行なわせてもよい。

【００１６】さらに、被写体１の反射率の差によるイメージの濃淡差を補正してもよい。すなわち、レーザ光源２を直流点灯させてイメージインテンシファイヤ管３も変調動作させないで、被写体１からの反射光をあらかじめ計測しておく。そして．上述した実施例の計測を行なうときに、この直流点灯．無変調で計測しておいたデータを用いて、正弦波点灯および正弦波変調におけるイメージデータを補正することにより、被写体１の反射率の差による濃淡の差をキャンセルする。ここで、距離情報の読み出しをＴＶカメラ９で行なうものとすれば．画像メモリを用いて補正用の撮像と計測用の撮像を交互に繰り返すことにより、ダイナミックに距離情報が得られる。

【００１７】

【発明の効果】以上の通り．本発明では、イメージインテンシファイヤ管のゲインを正弦波変調し、同時に被写体には上記イメージインテンシファイヤ管の変調周波数と同一または少しずれた周波数で輝度変調されたレーザ光を照射しているので、距離に応じて濃淡が周期的に繰り返して変化する情報が得られる。さらに、ゲート手段の制御により．イメージインテンシファイヤ管のゲイン変調周期の略１／４以下の周期であってゲインが単調増加または減少する期間のみイメージインテンシファイヤ管の出力をオンとすることで、このゲート手段によるレーザレンジゲートにより設定された距離範囲のみ．被写体の測定結果を濃淡イメージで得ることができる。

【図面の簡単な説明】

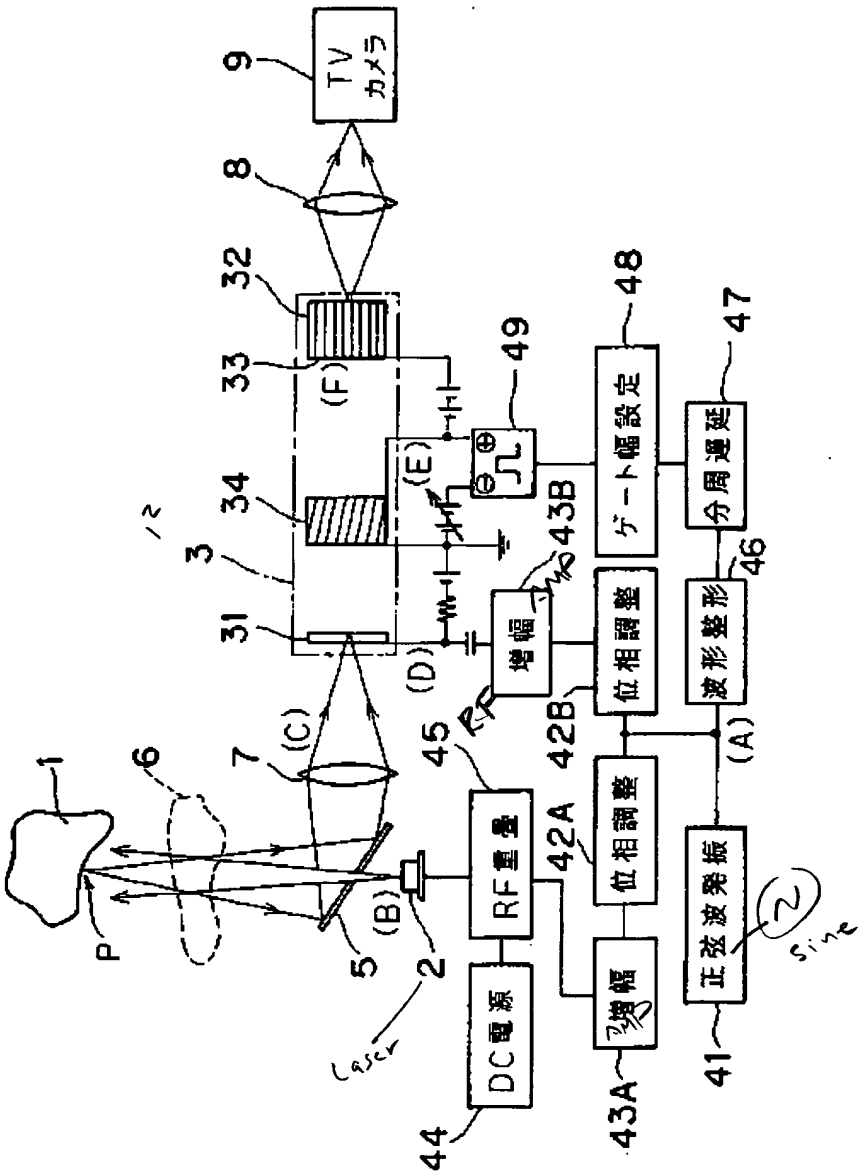
【図１】実施例のイメージレーザレーダ装置の構成図。

【図２】実施例の動作を示す波形図。

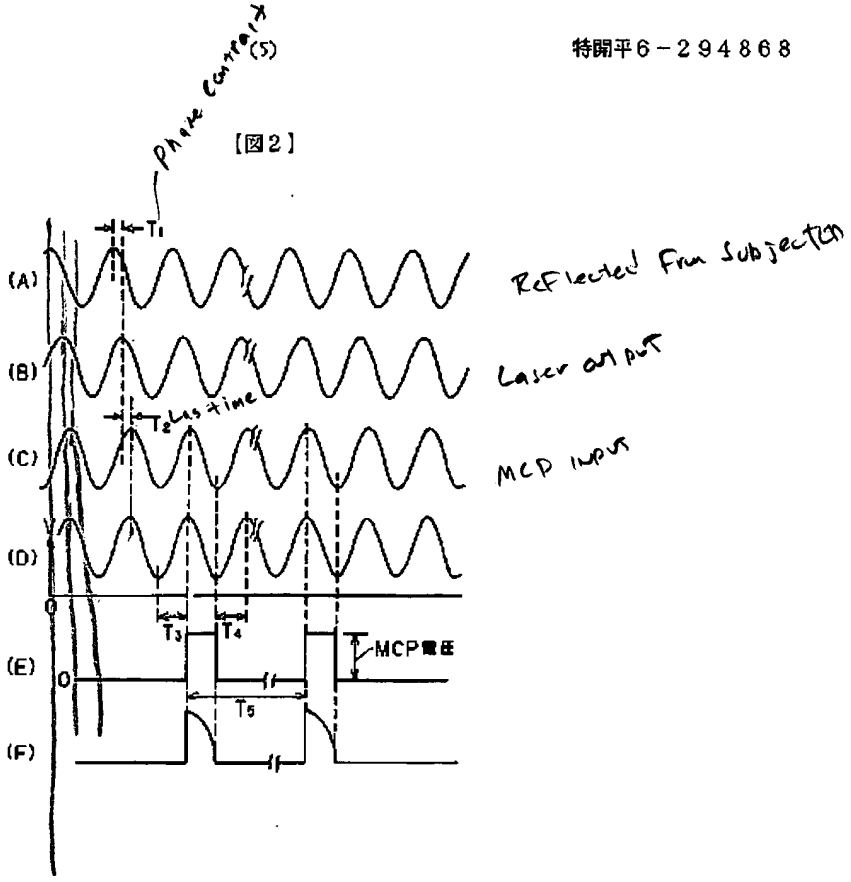
【符号の説明】

１…被写体、２…レーザ光源、３…イメージインテンシファイヤ管、３１…光電面．３２…ファイバ光学プレート．３３…螢光面、３４…ＭＣＰ、４１…正弦波発生回路．４２…位相調整回路．４３…増幅器、４４…ＤＣ電源回路、４５…ＲＦ重畳回路、４６…波形整形回路、４７…分周および遅延回路．４８…ゲート幅設定回路、４９…ＭＣＰゲート駆動回路。

【図1】



【図2】



PATENT ABSTRACTS OF JAPAN

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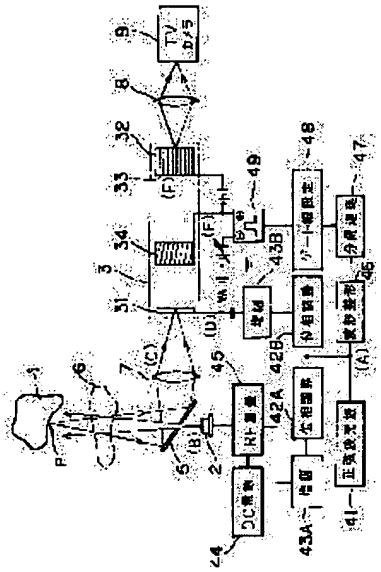
(71)Applicant : **HAMAMATSU PHOTONICS KK**
(72)Inventor : **NAKAMURA HARUHITO**

(54) IMAGE LASER RADAR EQUIPMENT

(57)Abstract:
PURPOSE: To display measurement result with the light and gray-scale image of an image by turning on the output of an image intensifier (II) tube only while its gain increases or decreases monotonously.
CONSTITUTION: A sinusoidal wave generation circuit 41 generates a sinusoidal voltage and the output is given to amplifiers 43A and 43B via phase adjustment circuits 42A and 42B. A laser beam from a light source 2 is projected to a subject 1. The reflection light is reflected by a mirror 5 and enters an II tube 3. The output of the amplifier 43B, namely a sinusoidal voltage, is given to an photoelectric surface 31, thus modulating gain. The output of a gate amplification constant circuit 48 is given to a gate drive circuit 49 and the output is applied to a micro channel plate 34 for gate operation, thus turning on the output of the II tube only while the gain of the II tube 3 increases or decreases monotonously and hence displaying a close position brightly and a distant position with a dark in gray scale.



LEGAL STATUS

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[Date of registration]	29.08.1997
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[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to image laser radar equipment.
[0002]
[Description of the Prior Art] Ranging using the phase-comparison method (light modulation phase-comparison method) is known. This sends out the continuous wave (light beam) which carried out intensity modulation by the sine wave, and after it receives and detects the reflected light from a photographic subject, it ranges it by comparing the phase of a sending-out wave and a detected wave. In this ranging, the technology of raising S/N of ranging is indicated by JP,2-13878,A by applying the gate by the receiver side. The distance to a photographic subject can be measured correctly, without being influenced by the scatterer which exists in the atmosphere to a photographic subject according to this.
[0003]
[Problem(s) to be Solved by the Invention] However, about the receiving means of the reflected light from a photographic subject, an exceptional work is not carried out but, for this reason, the above-mentioned conventional technology of practical value is inadequate. By the way, there are some which are called approached type II (image intensifier) pipe as a receiving means to perform laser range gate operation. According to this device, the feeble lightwave signal from a photographic subject is also reproducible as a reinforced image.
[0004] Then, this invention aims at offering the new image laser radar equipment which is not in the former by utilizing the feature of this approached type II pipe.
[0005]
[Means for Solving the Problem] The image laser radar equipment concerning this invention The laser light source which projects the outgoing radiation light by which intensity modulation was carried out by predetermined frequency on a photographic subject, The image-intensifier pipe with which it has the function which receives the reflected light from a photographic subject and carries out image reinforcement, and gain is modulated by predetermined frequency, It is characterized by having the gate means which sets the output of an image intensifier to ON only in the period when it is a 1/4 or less abbreviation [for the gain modulation period of this image-intensifier pipe] period in, and gain increases or decreases in monotone.
[0006]
[Function] In this invention, a pulse or a sinusoidal voltage is impressed to the photoelectric surface or MCP (micro channel plate) of an image-intensifier pipe, and simultaneously, when the laser beam by which intensity modulation was carried out on the frequency shifted for a while is irradiated, therefore these periods synchronize, the same as that of the modulation frequency of the above-mentioned image-intensifier pipe or the information from which a shade changes repeatedly according to distance periodically is acquired by the photographic subject. For this reason, only the range set up by the laser range gate by this gate means because only the period when it is a 1/4 or less abbreviation [for the gain modulation period of an image-intensifier pipe] period, and gain decreases [when decrease and it monotonous-increases] sets the output of an image-intensifier pipe to ON by control by the gate means can obtain a ranging result in the shade image of a picture.
[0007]
[Example] Hereafter, one example of this invention is explained with reference to drawing 1 and 2. Drawing 1 is the block diagram showing the composition of the image laser radar equipment concerning an example, and drawing 2 is the wave form chart showing operation of this example. The image laser radar equipment of this example equips a photographic subject 1 with the laser light source 2 which projects the laser beam by which intensity modulation was carried out, the image-intensifier pipe 3 which receives the reflected light from a photographic subject 1, and the circuit system which controls these operation, and is constituted from a sine wave as shown in drawing 1 .
[0008] The sinusoidal generating circuit 41 generates the sinusoidal voltage used as the criteria of intensity modulation, a gain modulation, and gate operation timing, and the output is given to Amplifier 43A and 43B through the phase adjustment circuits 42A and 42B. Phase adjustment circuit 42A and B give phase contrast to the output of the sinusoidal generating circuit 41, and amplifier 43A and B only amplify the sinusoidal voltage to which phase contrast was given. RF superposition circuit 45 to which DC power is supplied from the DC-power-supply circuit 44 superimposes the sinusoidal voltage from amplifier 43A on a subcarrier, i.e., predetermined RF, and gives it to a laser light source 2. The laser beam from the laser light sources 2, such as a laser diode, lets the through hole formed in the mirror 5 pass, and it is projected on it all over space

towards a photographic subject 1. In addition, all over the space between a photographic subject 1 and a laser light source 2, the quality 6 of an obstruction which produces dispersion etc. floats and exists.
[0009] The reflected light from a photographic subject 1 is constituted so that it may be reflected by the mirror 5 and incidence may be carried out to the image-intensifier pipe 3 through a lens 7. The image-intensifier pipe 3 has the photoelectric surface 31 in the inside of a light-receiving face-plate, it has the fluorescence side 33 in the inside of the fiber-optics plate 32 which is an output screen, and MCP34 for electronic multiplication is formed into the vacuum housing between the photoelectric surface 31 and the fluorescence side 33. And the optical image of the fluorescence side 33 is picturized by TV camera 9 through the fiber-optics plate 32 and a relay lens 8.
[0010] Here, the output of amplifier 43B, i.e., a sinusoidal voltage, is given to the photoelectric surface 31 of the image-intensifier pipe 3, and the gain modulation is made by this. Moreover, the sinusoidal voltage from the sinusoidal generating circuit 41 is shaped in waveform by the waveform shaping circuit 46, and is given to the gate width setting circuit 48 through dividing and a delay circuit 47. And the output of the gate width setting circuit 48 is given to the MCP gate drive circuit 48, this output is impressed to MCP34 and gate operation is carried out.
[0011] The timing chart of drawing 2 explains operation of the above-mentioned example. In drawing 2 , the sinusoidal-voltage wave (A) shows the on-the-strength wave of the reflected light from the photographic subject 1 which makes the output wave of the sinusoidal generating circuit 41, and an optical on-the-strength wave (B) the on-the-strength wave of the output laser beam of a laser light source 2, and makes incidence of the wave (C) to the photoelectric surface 31 of the image-intensifier pipe 3. here -- phase contrast T1 between waves (A) (B) it sets up by phase adjustment circuit 42A -- having -- a wave (B) and phase contrast T2 between (C) It is a time lag by the propagation in the space of a laser beam.
[0012] The wave (D) of a periphery is a voltage waveform of the photoelectric surface 31, and this synchronizes with the input luminous-intensity change to a wave (C) 3, i.e., an image-intensifier pipe. A wave (E) is a gate voltage given to MCP34, and photoelectron multiplication according to MCP34 only in the period when the gate voltage has just become is carried out. That is, the period T3 before and behind it and T4 Since a period becomes the same as the shutter having been closed, a photographic subject's 1 information will be photographed only for a wave-like (E) pulse period as an image. In addition, wave-like (E) pulse separation T5 Timing is adjusted by dividing and the delay circuit 47.
[0013] The wave (F) of drawing 2 is the voltage waveform of the fluorescence side 33 of the image-intensifier pipe 3, i.e., the optical output wave to TV camera 9. That is, except when the voltage of MCP34 is positive like a wave (E), the optical output of the fluorescence side 33 serves as zero, and only when the voltage of MCP34 is [the gate] open by positive, the fluorescence side 33 outputs an image. At this time, the voltage (wave (D)) to the period and the photoelectric surface 31 to which the input light intensity to the photoelectric surface 31 which shows the period which the gate is opening to a wave (C) decreases in monotone decreases in monotone (it is got blocked). Since it corresponds to both periods when gain decreases in monotone, the image of only the period of ON of MCP voltage turns into an image of a fixed range, and it will be bright in a near position, and a distant position will be darkly displayed by the shade.
[0014] Although the gate period of the image-intensifier pipe 3 is set as the period in which the intensity of the reflected light from the gain and the photographic subject 1 of the image-intensifier pipe 3 carries out monotonous reduction in the above-mentioned example, you may set the gate period of the image-intensifier pipe 3 as the period in which the incident-light intensity to gain and the image-intensifier pipe 3 carries out a monotonous increase. If it does in this way, among the photographic subjects in a fixed range, a near thing will be dark and a shade indication of the far thing will be given brightly.
[0015] Moreover, the modulation of gain may be performed by carrying out the sinusoidal modulation of the applied voltage to MCP of the image-intensifier pipe 3, and gate operation may be made to perform by making the voltage to the photoelectric surface 31 of the image-intensifier pipe 3 turn on and turn off.
[0016] Furthermore, you may rectify the shade difference of the image by the difference of a photographic subject's 1 reflection factor. That is, the reflected light from a photographic subject 1 is beforehand measured without carrying out direct-current lighting of the laser light source 2 and carrying out modulation operation also of the image-intensifier pipe 3. and an image data [in / sinusoidal lighting and a sinusoidal modulation / using the data measured in this direct-current lighting and no becoming irregular when measuring the example mentioned above] -- an amendment -- the difference of the shade by the difference of a photographic subject's 1 reflection factor is canceled by things Here, distance information is dynamically acquired by repeating the image pck-up for an amendment, and the image pck-up for measurement by turns using the thing for which distance information is read, then an image memory by TV camera 9.
[0017]
[Effect of the Invention] As above, by this invention, the sinusoidal modulation of the gain of an image-intensifier pipe is carried out, and simultaneously, since the laser beam by which intensity modulation was carried out on the frequency shifted for a while is irradiated, the same as that of the modulation frequency of the above-mentioned image-intensifier pipe or the information from which a shade changes repeatedly according to distance periodically is acquired by the photographic subject. Furthermore, only the range set up by the laser range gate by this gate means because only the period when it is a 1/4 or less abbreviation [for the gain modulation period of an image-intensifier pipe] period, and gain decreases [when decrease and it monotonous-increases] sets the output of an image-intensifier pipe to ON by control of a gate means can obtain a photographic subject's measurement result in a shade image.

[Translation done.]

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] As above, by this invention, the sinusoidal modulation of the gain of an image-intensifier pipe is carried out, and simultaneously, since the laser beam by which intensity modulation was carried out on the frequency shifted for a while is irradiated, the same as that of the modulation frequency of the above-mentioned image-intensifier pipe or the information from which a shade changes repeatedly according to distance periodically is acquired by the photographic subject. Furthermore, only the range set up by the laser range gate by this gate means because only the period when it is a 1/4 or less abbreviation [for the gain modulation period of an image-intensifier pipe] period, and gain decreases [when decrease and it monotonous-increases] sets the output of an image-intensifier pipe to ON by control of a gate means can obtain a photographic subject's measurement result in a shade image.

[Translation done.]

MEANS

[Means for Solving the Problem] this invention is characterized by providing the following to image laser radar equipment. The laser light source which projects the outgoing radiation light by which intensity modulation was carried out by predetermined frequency on a photographic subject. The image-intensifier pipe with which it has the function which receives the reflected light from a photographic subject and carries out image reinforcement, and gain is modulated by predetermined frequency. The gate means which sets the output of an image intensifier to ON only in the period when it is a 1/4 or less abbreviation [for the gain modulation period of this image-intensifier pipe] period in, and gain increases or decreases in monotone.

[Translation done.]

OPERATION

[Function] In this invention, a pulse or a sinusoidal voltage is impressed to the photoelectric surface or MCP (micro channel plate) of an image-intensifier pipe, and simultaneously, when the laser beam by which intensity modulation was carried out on the frequency shifted for a while is irradiated, therefore these periods synchronize, the same as that of the modulation frequency of the above-mentioned image-intensifier pipe or the information from which a shade changes repeatedly according to distance periodically is acquired by the photographic subject. For this reason, only the range set up by the laser range gate by this gate means because only the period when it is a 1/4 or less abbreviation [for the gain modulation period of an image-intensifier pipe] period, and gain decreases [when decrease and it monotonous-increases] sets the output of an image-intensifier pipe to ON by control by the gate means can obtain a ranging result in the shade image of a picture.

[Translation done.]

EXAMPLE

[Example] Hereafter, one example of this invention is explained with reference to drawing 1 and 2. Drawing 1 is the block diagram showing the composition of the image laser radar equipment concerning an example, and drawing 2 is the wave form chart showing operation of this example. The image laser radar equipment of this example equips a photographic subject 1 with the laser light source 2 which projects the laser beam by which intensity modulation was carried out, the image-intensifier pipe 3 which receives the reflected light from a photographic subject 1, and the circuit system which controls these operation, and is constituted from a sine wave as shown in drawing 1 .

[0008] The sinusoidal generating circuit 41 generates the sinusoidal voltage used as the criteria of intensity modulation, a gain modulation, and gate operation timing, and the output is given to Amplifier 43A and 43B through the phase adjustment circuits 42A and 42B. Phase adjustment circuit 42A and B give phase contrast to the output of the sinusoidal generating circuit 41, and amplifier 43A and B only amplify the sinusoidal voltage to which phase contrast was given. RF superposition circuit 45 to which DC power is supplied from the DC-power-supply circuit 44 superimposes the sinusoidal voltage from amplifier 43A on a subcarrier, i.e., predetermined RF, and gives it to a laser light source 2. The laser beam from the laser light sources 2, such as a laser diode, lets the through hole formed in the mirror 5 pass, and it is projected on it all over space towards a photographic subject 1. In addition, all over the space between a photographic subject 1 and a laser light source 2, the quality 6 of an obstruction which produces dispersion etc. floats and exists.

[0009] The reflected light from a photographic subject 1 is constituted so that it may be reflected by the mirror 5 and incidence may be carried out to the image-intensifier pipe 3 through a lens 7. The image-intensifier pipe 3 has the photoelectric surface 31 in the inside of a light-receiving face-plate, it has the fluorescence side 33 in the inside of the fiber-optics plate 32 which is an output screen, and MCP34 for electronic multiplication is formed into the vacuum housing between the photoelectric surface 31 and the fluorescence side 33. And the optical image of the fluorescence side 33 is picturized by TV camera 9 through the fiber-optics plate 32 and a relay lens 8.

[0010] Here, the output of amplifier 43B, i.e., a sinusoidal voltage, is given to the photoelectric surface 31 of the image-intensifier pipe 3, and the gain modulation is made by this. Moreover, the sinusoidal voltage from the sinusoidal generating circuit 41 is shaped in waveform by the waveform shaping circuit 46, and is given to the gate width setting circuit 48 through dividing and a delay circuit 47. And the output of the gate width setting circuit 48 is given to the MCP gate drive circuit 48, this output is impressed to MCP34 and gate operation is carried out.

[0011] The timing chart of drawing 2 explains operation of the above-mentioned example. In drawing 2 , the sinusoidal-voltage wave (A) shows the on-the-strength wave of the reflected light from the photographic subject 1 which makes the output wave of the sinusoidal generating circuit 41, and an optical on-the-strength wave (B) the on-the-strength wave of the output laser beam of a laser light source 2, and makes incidence of the wave (C) to the photoelectric surface 31 of the image-intensifier pipe 3. here -- phase contrast T1 between waves (A) (B) it sets up by phase adjustment circuit 42A -- having -- a wave (B) and phase contrast T2 between (C) It is a time lag by the propagation in the space of a laser beam.

[0012] The wave (D) of a periphery is a voltage waveform of the photoelectric surface 31, and this synchronizes with the input luminous-intensity change to a wave (C) 3, i.e., an image-intensifier pipe. A wave (E) is a gate voltage given to MCP34, and photoelectron multiplication according to MCP34 only in the period when the gate voltage has just become is carried out. That is, the period T3 before and behind it and T4 Since a period becomes the same as the shutter having been closed, a photographic subject's 1 information will be photographed only for a wave-like (E) pulse period as an image. In addition, wave-like (E) pulse separation T5 Timing is adjusted by dividing and the delay circuit 47.

[0013] The wave (F) of drawing 2 is the voltage waveform of the fluorescence side 33 of the image-intensifier pipe 3, i.e., the optical output wave to TV camera 9. That is, except when the voltage of MCP34 is positive like a wave (E), the optical output of the fluorescence side 33 serves as zero, and only when the voltage of MCP34 is [the gate] open by positive, the fluorescence side 33 outputs an image. At this time, the voltage (wave (D)) to the period and the photoelectric surface 31 to which the input light intensity to the photoelectric surface 31 which shows the period which the gate is opening to a wave (C) decreases in monotone decreases in monotone (it is got blocked). Since it corresponds to both periods when gain decreases in monotone, the image of only the period of ON of MCP voltage turns into an image of a fixed range, and it will be bright in a near position, and a distant position will be darkly displayed by the shade.

[0014] Although the gate period of the image-intensifier pipe 3 is set as the period in which the intensity of the reflected light from the gain and the photographic subject 1 of the image-intensifier pipe 3 carries out monotonous reduction in the above-mentioned example, you may set the gate period of the image-intensifier pipe 3 as the period in which the incident-light

intensity to gain and the image-intensifier pipe 3 carries out a monotonous increase. If it does in this way, among the photographic subjects in a fixed range, a near thing will be dark and a shade indication of the far thing will be given brightly.
[0015] Moreover, the modulation of gain may be performed by carrying out the sinusoidal modulation of the applied voltage to MCP of the image-intensifier pipe 3, and gate operation may be made to perform by making the voltage to the photoelectric surface 31 of the image-intensifier pipe 3 turn on and turn off.
[0016] Furthermore, you may rectify the shade difference of the image by the difference of a photographic subject's 1 reflection factor. That is, the reflected light from a photographic subject 1 is beforehand measured without carrying out direct-current lighting of the laser light source 2 and carrying out modulation operation also of the image-intensifier pipe 3. and an image data [in / sinusoidal lighting and a sinusoidal modulation / using the data measured in this direct-current lighting and no becoming irregular when measuring the example mentioned above] -- an amendment -- the difference of the shade by the difference of a photographic subject's 1 reflection factor is canceled by things Here, distance information is dynamically acquired by repeating the image pck-up for an amendment, and the image pck-up for measurement by turns using the thing for which distance information is read, then an image memory by TV camera 9.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the image laser radar equipment of an example.
[Drawing 2] The wave form chart showing operation of an example.
[Description of Notations]
1 [-- The photoelectric surface, 32 / -- A fiber-optics plate, 33 / -- A fluorescence side, 34 / -- MCP, 41 / -- A sinusoidal generating circuit, 42 / -- A phase adjustment circuit, 43 / -- Amplifier, 44 / -- A DC-power-supply circuit, 45 / -- RF superposition circuit, 46 / -- A waveform shaping circuit, 47 / -- Dividing and a delay circuit, 48 / -- A gate width setting circuit, 49 / -- MCP gate drive circuit.] -- A photographic subject, 2 -- laser light source, 3 --

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[Translation done.]